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COMPLETE SPECIFICATION

Improvements in Method of Compounding Carbon Black and Rubber Latex

We, COLUMBIAN CARBON COMPANY, a corporation organized and existing under the laws of the State of Delaware, United States of America, of 41, East 42nd Street, New York, 17, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the compounding of rubber and carbon black and provides an improved method of agglutinating carbon black and natural or synthetic rubber or other polymeric materials available in latex form.

The use of carbon black as a reinforcing agent in rubber is well recognized. It has long been conventional practice to incorporate the carbon black in the rubber, after coagulation, by vigorous milling. This method has proved tedious and costly and, in some instances, has deleteriously affected the properties of the finished rubber product.

For many years, extensive effort has been made by the industry to develop an effective and commercially practical method of dispersing carbon black in rubber by mixing the black with the rubber latex prior to coagulation of the rubber, but, to our knowledge, present methods, while operable, leave much to be desired.

Current practice involves grinding the pelletized black in dry form and dropping the dust into a large vat containing water, a dispersing agent and a stabilizing agent, agitating to form a stable suspension of the carbon black and adjusting the pH of the suspension to that of the latex by adding caustic soda, or the like. The carbon black suspension is usually prepared in large batches and subsequently a portion of the batch, containing the dispersing agent, stabilising agent, carbon black, water and alkali, is mixed with a predetermined amount of the latex. Thereafter, salt or other creaming agent is added to the latex mixture and, when creaming has been effected, a coagulant, such as sulfuric acid or alum, is added and the resultant coagulum separated from the serum and dried. Thus the process is essentially a batch, or discontinuous operation.

Where this method has been used, a substantial proportion of the carbon black has been found to remain in the serum following coagulation and separation of the rubber. Also, difficulty has been experienced in the further processing of the rubber, and the characteristics of the resultant rubber compound have been generally inferior.

Efforts have been made to avoid the use of the dispersing agent. However, in practical operation, the use of a dispersing agent has heretofore been found necessary in order to maintain a uniform dispersion of the black, so as to control the proportion of black added to the latex, and to avoid excessive viscosity of the aqueous carbon black slurry during storage and processing.

It is an object of our present invention to provide a continuous process for agglutinating the carbon black with rubber, or the like, by which the use of dispersing agents, the grinding of the carbon black to form the aqueous dispersion and other objectionable features of the present practices may be entirely avoided. These and other objects are attained by our present invention, as will more clearly appear from the following disclosure thereof.

In accordance with our present process, the carbon black is continuously added, at a uniformly controlled rate, to a stream of water flowing at a uniform rate and mixed therewith, without grinding nor

the adding of a dispersing or stabilizing agent, by subjecting the black to hydraulic impact and agitation and, while continuing the agitation of the stream to keep the black in uniform suspension, suddenly combining the stream of the resultant carbon black slurry with a stream of the rubber latex, so as to effect substantially instantaneously uniform mixing of the two streams, and continuing to agitate the mixture until coagulation has been effected.

The process has the advantage of continuity and uniformity of operation and the avoidance of the necessity of providing mixing and storage tanks for preformed carbon black suspension. It avoids the cost and deleterious effects of dispersing and stabilizing agent and avoids the necessity of grinding the carbon black.

The process is applicable to all types of carbon black whether pelleted or in the flocculent form and is also applicable to the agglutination of the black with either synthetic or natural rubber or other polymeric material available in latex form.

The process is of particular utility in agglutinating carbon black in synthetic rubber of the GRS type and especially such synthetic rubber in the preparation of which the polymerization of butadiene and styrene is effected at low temperatures.

The hydraulic impact is, with advantage, effected by hitting the black as it enters the system with a high velocity stream or jet of water or water and steam. As an alternative procedure, the black may first be roughly dispersed in the water and this mixture subjected to violent impact with a steam jet. The mixing of the resultant aqueous suspension of the black with the latex is, with advantage, effected either by violent impact of the stream of carbon black suspension with a stream of latex or by violent mechanical agitation.

For example, we have successfully employed a Shutte-Koerting steam eductor to make the carbon black slurry, without adding any dispersing agent or grinding the black. We then passed the resultant slurry stream to a second eductor, in which the latex was the energizing fluid, and the black was thereby continuously, instantaneously and uniformly mixed with the latex. Creaming, coagulating, washing and drying followed.

Alternatively, we have employed mechanical means to provide a high velocity turbulent stream of water into which the black was continuously introduced in dry form, and broken up, dispersed and suspended by the velocity and turbulence of the water stream. We then immediately mixed the resultant stream of slurry with a high velocity stream of latex, effecting substantially instantaneous and uniform intermingling of the two streams. This step was then likewise followed by creaming, coagulating, washing, and drying.

By either of these procedures, the process is continuous and the proportions of carbon black mixed with the rubber are readily controlled. The necessity of storage vessels for preformed carbon black slurry and the danger of lack of uniformity of proportions of carbon black in the finished product due to variations of the proportion of carbon black in the preformed slurry used are entirely avoided. After the proportioning devices have been set to give the desired proportions, the process may be carried on continuously with a minimum of attention from operators. The invention has the further advantage of relatively low cost and readily available equipment with a minimum of factory space required for the operation.

The proportion of carbon black used may vary within the range conventionally used as reinforcing agent in the compounding of rubber, and the like, for instance, from 30 to 70 or more parts of dry carbon black per 100 parts of rubber solid.

In operations, in accordance with the process of our invention, the necessity of adjusting the *ph* of the carbon black slurry to the *ph* of the latex is entirely avoided. Further, the adding of a salt, or other creaming agent, is unnecessary and the amount of acid, or other coagulating agent required, is substantially reduced. Also, substantially all of the carbon black added to the latex is taken up by the coagulated polymer and a substantially clear serum is obtained, thus avoiding loss of any substantial amount of the carbon black.

Further, compounded rubbers, more particularly tire tread compound, in the preparation of which the carbon black is dispersed in the latex as herein described, will be found to have a faster curing rate and a higher modulus and better tear characteristics than that prepared by conventional procedure.

What we claim is:—

1. In the process of producing dispersions of carbon black in natural or synthetic rubber or other polymeric material available in latex form in which the black is mixed with the rubber while in latex form and the carbon black-latex mixture thereafter coagulated, the steps of continuously mixing carbon black with a confined stream of water flowing at a uniform rate in uniform, measured proportions in the absence of added dispersing agents by

subjecting the black to hydraulic impact and agitation and thereby forming a continuously flowing confined stream of an aqueous carbon black slurry of uniform composition and immediately thereafter while continuing the agitation to keep the black in uniform suspension, suddenly combining the stream of the resultant carbon black-slurry with a stream of rubber latex, effecting substantially instantaneously uniform mixing of the two streams and continuing agitation until coagulation has been effected.

2. The process according to claim 1 in which the carbon black is a furnace black.

3. The process according to claim 2 in which the latex is a synthetic rubber latex.

4. The process according to claim 3 in which the synthetic rubber latex is a latex of a copolymer of butadiene and styrene.

5. The process of claim 4 in which the latex is that of a low temperature copolymer of butadiene and styrene.

6. In the process of producing dispersions of carbon black in natural or synthetic rubber or other polymeric material available in latex form in which the black is mixed with the rubber while in latex form and the carbon black-latex mixture thereafter coagulated, the steps of continuously charging the carbon black to a mixing conduit, striking the black as it enters the conduit with a high velocity jet of water, the water and carbon black being supplied in uniform predetermined proportions, and thereby suspending the carbon black in the water, continuing the flow of the resultant suspension through the conduit as a turbulent stream and uniformly mixing the turbulent stream of the suspension with a stream of the rubber latex and continuing agitation of the mixture until coagulation has been effected.

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ERRATUM

SPECIFICATION NO. 839,533

Page 2, line 44, *for* "pensed" *read* "pended"

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